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HISTORY OF STOCKPILE PROBLEMS (u)

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Briefing for the Defense Science Board CTB Panel, July 19, 1979

I. Case studies, experience during the 1958-1961 moratorium.

Background

A. In response to a growing Soviet nuclear weapon capability the United States in 1954 tested and began deployment of several thermonuclear weapons as an "emergency capability."

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weapons began entry into stockpile in 1959, after the moratorium had started on an announced year-to-year basis. It is useful to compare the strategic stockpiles in FY '58 and FY '61:

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In the years following FY '61 numbers of the newer weapons deployed increased rapidly, as the older ones were retired. There had been thirty types of weapons introduced into stockpile by 1958; of these 12 had been retired at an average age of 3.8 years, and those remaining had an average age of only 2.8 years. Clearly this country was, in 1961, heavily dependent on a very new technology for its defense.

B. The 1956 Suez and Hungarian episodes, the 1961 Soviet massive resumption of testing, and the 1962 Cuban missile crisis are indications of the international tension during the period surrounding the moratorium.

C. In spite of the moratorium, 13 phase threes were initiated in the period 1958-1960 in response to DOD requirements. In addition to theater weapons these included warheads for Polaris A1 and A3 and Minuteman I and II, and for Atlas, Titan I, and Titan II, as well as new bombs for the Air Force B52. Although the year-to-year nature of the moratorium implied that testing would be resumed to develop the weapons in phase three, no preparations were made for test resumption until the Soviet series began in September 1961.

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Against this background, it is appropriate to review the history of stockpile problems during the moratorium and the years following. The discussion will be limited to cases in which nuclear testing was either indispensable in the discovery of a problem or in the solution of a problem or both; cases capable of discovery and solution by alternative administrative actions [redacted] are omitted, even though in several such cases nuclear testing has been strongly indicated as the most cost-effective and reliable course of corrective action. It must be recognized, however, that national policy rendered some possible administrative actions impermissable, so that it is impossible to divorce the subject of stockpile problems from policy issues entirely as is sometimes attempted. DOE b(3)

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The experiments and essential post-moratorium tests described here served to delineate the risk/benefit situation with regard to one-point safety, providing a basis for subsequent administrative judgments; while not all weapons affected were retrofitted to the most inherently safe configurations, the decisions made were informed by the test results as well as other considerations such as deployment modes and economic factors.

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[redacted]

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In summary:

- [redacted]

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- A suitable candidate replacement primary was believed to be available, pending confirmation by nuclear test.
- Nuclear testing of the replacement confirmed the modification.

[redacted]

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It should be noted that the decisions to change the HE in case (D), and to deploy the B57 without test of its intermediate yield, if necessary, were made by experienced, knowledgeable design personnel, informed by the results of extensive non-nuclear testing, and these decisions were ratified by senior management. The changes were deemed to be minor extensions of tested experience. If testing had not resumed, moreover, several of the weapons in phase three during the moratorium were planned for deployment without test, in response to stated DOD requirements for those weapons.

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F. Summary

Had testing not resumed in 1961, there would have been the following effects on the stockpile of that period:

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Weapons effects tests at the NTS have been used to assess the reliability of our weapons against enemy defenses, including effects of neutron-caused fission heating, X-ray caused material blowoff and impulse, X-ray caused thermal loads in structures, X-ray- and gamma-ray-caused internal electromagnetic pulse currents in detonators, cables, and other electronic components. The experiments have often revealed deficiencies in our designs and have allowed corrective measures to be taken and verified. Most of these experiments require a nuclear weapon source, and most of our knowledge regarding system hardness/vulnerability would not be available had testing not resumed in 1961. In the past, hardness requirements have changed as the perceived threat changed.

It should also be noted that, had testing not resumed, a number of major weapon systems would have been deployed without test in response to pressing DOD requirements. Many of these would have been subject to difficulties similar to those described above, but we would not have known this. That few troubles have arisen in the post-moratorium systems is a direct result of the knowledge gained after the resumption of testing.

6. Parallels and Differences

In order to relate the moratorium experience to the present time it is necessary to examine the similarities and differences between the situations then and now. A major difference is that, at the time of the moratorium, many weapon requirements remained to be fulfilled involving major strategic and theater weapon systems. Today, most known requirements are nearly in hand with tested devices. Future requirements, however, are not ruled out in the Nuclear Weapon Development Guidance, and the DOD injunction that DOE must be prepared to meet them in a CTB environment must be a cause for great concern.

A major similarity between 1958-61 and the present, which also may cause concern, is that the nation is again embarking on the deployment of many newly designed and tested weapons, affecting most of its strategic and many of its theater systems. The new weapons in many cases are as technologically advanced, compared with those they replace, as were the weapons deployed during and shortly after the moratorium. The testing of some of the new weapons was curtailed by the early impact of the Threshold Test Ban Treaty. Some involve new and different high explosives, for which there is no stockpile experience. Design intent is now in the process of translation into production engineering in several cases. In these respects the parallel with 1958-61 is striking.

There is another parallel. In the '60's one-point safety was the dominant environmental concern and caused many problems in design later to haunt us. In the '70's plutonium scattering became a problem, resulting in the development of insensitive high explosive. In the '80's the intrinsic radiation (INRAD) problem may become severe. None of these three problems have been fully resolved throughout the stockpile; all may be expected to lead to pressure to further modify existing weapons. Such modifications are not safely undertaken in the absence of nuclear testing; resumption of testing after a three-year CTB would make them impossible.

A final difference between the moratorium era and today is that the laboratories now have ten times the experience in the design of boosted weapons than they then had. In the process of accumulating this experience, however, they have learned one lesson beyond doubt: [redacted]

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2. Reliability/Confidence Testing Statistics

It has been observed that only rarely has a weapon been taken from stockpile and fired for assurance, and that it is "rare to the point of non-existence" for a problem revealed by the surveillance program to require a nuclear test for its resolution.

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The first statement is partially true, in that only a few weapon [illegible] are correctly described by these words. However, this fact [illegible] weighed against the background of the entire test program [illegible] years. In the course of this program, a very large number of the tests conducted contributed directly to the confidence this country has in its nuclear weapons.

This fact was elucidated in a recent study prepared at the request of the Senate Armed Services Committee. Tests in several categories, all directly related to stockpile weapons, were enumerated:

Category	Number of Tests/Interactions
• Confidence or Operational System Tests	6/6
• Source for Weapons Effects	21/27
• Seismic Calibration	5/6
• Other	6/6

All of these tests involved war-reserve weapons drawn from the stockpile. But, in addition, many other tests relevant to stockpile confidence were identified:

Category	Number of Tests/Interactions
• Stockpile Primary (War Reserve)	9/12
• Stockpile-type Weapons	24/24
• Stockpile-type Primary	69/101

In addition, there have been 44 Vulnerability and Effects tests that affected confidence in stockpile weapons in 116 instances. (The number of test-weapon interactions is greater than the number of tests simply because many tests involve components of more than one stockpile weapon.)

The striking result of the study referred to is the large number of post-proof-test nuclear events that confirmed (in the great majority of cases, but not all) the correctness of designs, particularly of primaries, in stockpile, and the continued reliability of the nuclear weapon product. Results of these tests have been monitored carefully by the laboratories, and the tests have served as a partial substitute for stockpile reliability testing that might otherwise have been considered necessary.

This raises two legitimate questions: What concerns about the reliability of the stockpile might have arisen in the absence of this large body of tests; would strict "reliability testing" have been more common? And, what will substitute for this broad testing base in the case of the systems about to enter the stockpile under a CTB, for which only development and proof-testing, in general, is in hand?

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